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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/719,648 | 11/21/2003 | Heinz-Peter Frerichs | Micronas.7388 | 2362 |

7590 12/21/2005

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| EXAMINER | |
|---|---|
| INGHAM, JOHN C | |
| **ART UNIT** | **PAPER NUMBER** |
| 2814 | |

DATE MAILED: 12/21/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/719,648 | FRERICHS, HEINZ-PETER | |
| | Examiner | Art Unit | |
| | John C. Ingham | 2814 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *25 November 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

## DETAILED ACTION

### *Response to Amendment*

1. Applicant's amendment dated November 25th, 2005, in which the specification, abstract, and claims 1, 8, and 15 were amended has been entered of record.

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 1-7 and 15-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Frerichs (US 6,929,728), hereinafter "Frerichs '728", in view of Tada (US 6,525,390), hereinafter "Tada". It is noted that Frerichs '728 has a prior publication date of Oct. 31, 2002, which predates the instant application by more than one year.

Regarding claims 1 and 15, Frerichs '728 discloses in Figures 1 and 2 a sensor for measuring an ambient parameter, comprising: a drain (5); a source (2); a channel region (4) disposed between the drain and the source; a conductive guard ring (1) disposed outside the channel region; a sensitive gate layer (8) with a potential that depends on the ambient parameter; and an air gap (10) disposed between the gate layer and the channel region. Furthermore, with regard to claim 1, Frerichs discloses in Figures 1 and 2 a substrate (11) with drain and source disposed thereon.

Frerichs '728 also discloses in Figure 2 an insulating layer (14) disposed between the guard ring (1) and the channel region (4), the insulating layer having a surface (15) on which is disposed a ring structure (7). Frerichs '728 does not, however, specifically disclose the ring structure (7) having a surface conductivity different from a surface conductivity of a remaining portion of the surface of the insulating layer (14).

Tada discloses in Figure 34a a ring structure (207 along with 220, formed of resistive aluminum) having a surface conductivity different from a surface conductivity of a remaining portion (figure 34b, items 211 and 212). Items 211 and 212 in Figure 34b are insulation films, and are of similar structure as the field oxide film (8) in Figure 2. It is well known that field oxide is synonymous with thick silicon dioxide.

It would have been obvious to one of ordinary skill in the art at the time of the invention to improve upon the ring structure of Frerichs '728 by using the teachings of Tada to create a field plate with annular ring structures of a second conductivity type upon it. Motivations to do so include the desirability of having a uniform potential gradient across the field oxide film (Tada col. 18 ln. 16), avoiding voltage concentrations

between the gate and drain regions, and reduction of the intensity of the electric fields associated with PN junction termination.

Regarding claims 2 and 16, the sensor structure taught by Frerichs '728 in view of Tada (fig. 34a) discloses the sensor of claims 1 and 15, further comprising surface profiling formed with respect to the insulating layer and having at least one elevation (207) and at least one depression (212), and disposed between the guard ring and the channel region. Refer to Tada, figure 4, for the appropriate cross section.

Regarding claims 3 and 20, Frerichs '728 discloses the sensor of claims 2 and 15, further comprising a second insulating layer disposed over the channel region (col. 2 ln. 23).

Regarding claim 4, Tada discloses in figure 34a a ring structure (207 along with 220), which is comprised of an insulating material (resistive aluminum) disposed on the insulating layer (figure 34b, items 211 and 212).

Regarding claim 5, Tada discloses in figure 34a a ring structure (207 along with 220), wherein the ring structure comprises a concentric structure.

Regarding claims 6 and 17, Frerichs '728 discloses the sensor of claims 2 and 15, where the ambient parameter comprises a gas concentration (claim 1 of that patent, see col.2 ln. 1).

Regarding claims 7 and 18, Frerichs '728 discloses the sensor of claims 2 and 15, where the parameter comprises an ion concentration (claim 1 of that patent, see col. 2 ln. 1-2).

Regarding claim 19, Frerichs '728 discloses the sensor of claim 15, where the insulating layer (14) comprises an oxide layer (col. 1, ln. 66-67).

4. Claims 8-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Frerichs '728 and Tada as applied to claims 1-7 above, and further in view of Paris, R. et al, hereinafter "Paris".

Regarding claim 8, Frerichs '728 discloses in Figures 1 and 2 a sensor for measuring a concentration of an ambient parameter, comprising: a substrate (11); a channel region (4) formed in the substrate; a conductive guard ring (1) arranged outside the channel region; a sensitive gate layer (8) whose potential depends on the concentration of the ambient parameter, an air gap (10) disposed between the gate layer and the channel region; an oxide layer (14) disposed between the guard ring and the channel region, with the surface (13) of the oxide layer having a ring structure (7) arranged thereon. As stated previously, Tada discloses in Figure 34a a ring structure (207 along with 220, formed of resistive aluminum) having a surface conductivity different from a surface conductivity of a remaining portion (figure 34b, items 211 and 212).

The combination of Frerichs '728 and Tada, as applied to claims 1-7 above, does not teach a source and drain forming a field-effect transistor, the transistor being spatially separated from the air gap between the gate layer and the channel region, the transistor having a gate that is connected by an electrode to the channel region.

Paris discloses in figure 1 a source and drain forming a field-effect transistor (item FET in figure), the transistor being spatially separated from the air gap (area bounded by the gate, nitride, and distance pieces) between the gate layer and the channel region (area under the substrate between the guard rings), the transistor having a gate that is connected by an electrode to the channel region.

It would have been obvious to one of ordinary skill in the art at the time of the invention to create a capacitively controlled transistor by adding the teachings of Paris to the device already created by Frerichs '728 and Tada. The motivation to do so includes the positive effect of the CCFET structure in regards to temperature dependency and long term stability (Paris, pg. 424).

Regarding claim 9, Frerichs '728 discloses the sensor of claim 8, where the ambient parameter comprises a gas (claim 1 of that patent, see col.2 ln. 1).

Regarding claim 10, the sensor structure taught by Frerichs '728 in view of Tada (fig. 34a) discloses the sensor of claim 8, further comprising surface profiling formed with respect to the insulating layer and having at least one elevation (207) and at least one depression (212), and disposed between the guard ring and the channel region. Refer to Tada, figure 4, for the appropriate cross section.

Regarding claim 11, Frerichs '728 discloses the sensor of claim 8, further comprising an insulating thin layer disposed over the channel region (col. 2 ln. 23).

Regarding claim 12, Tada discloses in figure 34a a ring structure (207 along with 220), which is comprised of an insulating material (resistive aluminum) disposed on the oxide (figure 34b, items 211 and 212).

Regarding claim 13, Tada discloses in figure 34a a ring structure (207 along with 220), wherein the ring structure comprises a concentric structure.

Regarding claim 14, Frerichs '728 discloses the sensor of claim 8, where the ambient parameter comprises an ion concentration (claim 1 of that patent, see col. 2 ln. 1-2).

***Response to Arguments***

2. Applicant's arguments filed November 25th, 2005 have been fully considered but they are not persuasive.

Applicant submits (as regarding claims 1, 8, and 15) that nowhere in Tada is there a teaching that different surface conductivities are formed between the channel region and the conductive guard ring. Tada teaches a ring structure of resistive aluminum disposed on a surface of silicon dioxide (inherent different surface conductivities), while Frerichs '728 discloses the ring structure/insulating layer between the guard ring and the channel region. The argument that this structure is "to increase an amount of time in which the potential of the channel region equals the potential of the conductive guard ring" does not place a structural limitation onto the device as claimed, however, if it did, Frerichs '728 discloses in column 1, line 60 this identical language. The argument that items 211 and 212 in Tada Fig. 34b are disposed entirely beneath the two aluminum layers is incorrect. The cross section of Figure 34a is denoted by line X-X, and is along, not across, an aluminum ring. The plan view of Figure 34a as well as other cross sections should make clear that the aluminum ring is disposed in annular

fashion with areas of the oxide exposed between. Finally, the argument that the equal potential occurs between the guard ring and the channel in the claim, which is different than Tada, is not persuasive since the ring material of Tada is combined with the location of the ring structure taught by Frerichs '728. The motivation to combine is still applicable, "obtaining an almost uniform potential gradient in the spiral thin film formed in the field oxide film between the source electrode and the drain electrode, equalizing the local potential of the substrate with the local potential of the spiral thin film".

***Conclusion***

3. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John C. Ingham whose telephone number is (571) 272-8793. The examiner can normally be reached on M-F, 8am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

jci

GEORGE ECKERT
PRIMARY EXAMINER